

ENERGY WISE PROJECTS



Ground Source Heat Pump (GSHP)
Naval Air Station (NAS) Oceana — Dam Neck Annex

► Waste Not, Want Not — Reusing Waste Water to Save Energy and Reduce HVAC Costs

The Challenge

The population at NAS Oceana Dam Neck Annex in Virginia Beach was growing rapidly. This led not only to increased energy consumption, but also to the need to renovate old structures—while dealing with budget cuts.

In an effort to find energy savings solutions that wouldn't put too much of a financial burden on Oceana, the Public Works Department Oceana explored a wide array of possibilities. One of the first ideas they considered was ground source heat pumps (GSHP) (also called geothermal or water source heat pumps) for heating and cooling, using water from pipes buried several feet below ground level where the temperature is warmer in the winter and cooler in the summer.

The Solution

Upon further investigation, Public Works Department Oceana and Trane Corporation realized that they could achieve the benefits of GSHP without drilling by using effluent—waste water—to heat and cool. Discussions with Hampton Roads Sanitation District led to the reuse of a sewage treatment plant effluent to provide these benefits.

The project shut down an inefficient central steam system and replaced it with a combination of distributed boilers and geothermal heat pumps coupled to a condenser water loop, which would also replace cooling towers and air-cooled chillers for base chilled water systems. The condenser water loop is cooled with the effluent.

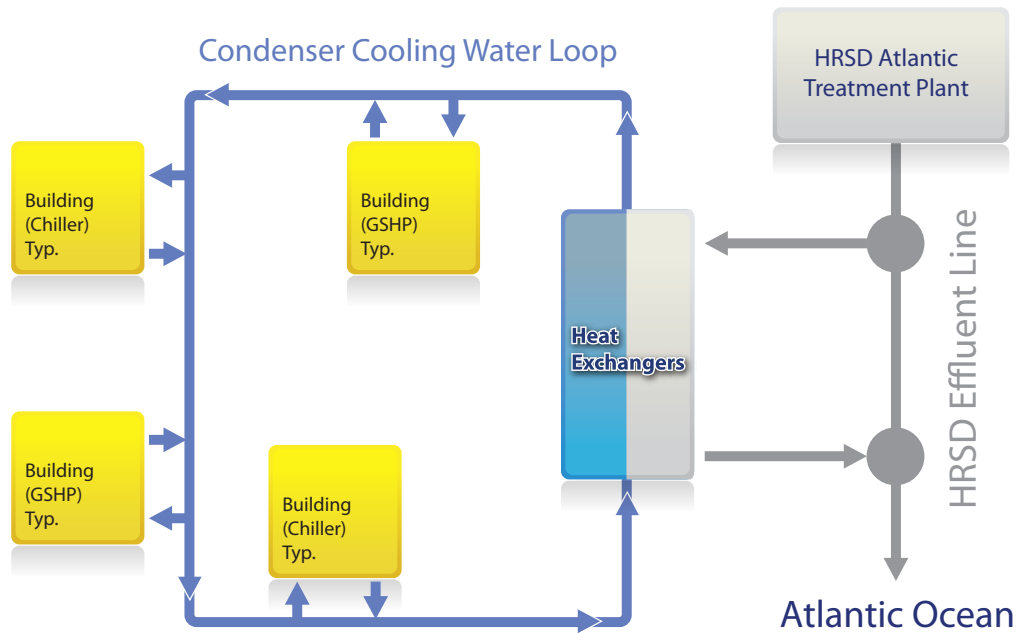
Although an economic analysis showed that the life expectancy and cost of installing an effluent/condenser cooling water loop would be approximately the same as installing a traditional ground loop, the effluent system offers some advantages:

- Effluent is more efficient than a ground-coupled system (winter and summer).
- No issues related to building up ground temperatures over time.
- Effluent system can be used with existing chillers.
- Effluent/condenser cooling water loop has large growth potential at minimal additional cost.

In the second quarter of Fiscal Year 2007, Oceana initiated the installation of a 450 ton ground source geothermal heat pump system and a 4,400 ton condenser cooling water loop which is cooled by the effluent from the Hampton Roads Sanitary District, Atlantic Treatment Plant. It would use approximately 14 million gallons of waste water a day as a heat sink for new and replacement chillers and heat pumps.



► Heat Exchanger/HRSD Effluent System



The Funding

After finding the energy solution, the Dam Neck team turned to funding. The financial solution was a \$33 million Energy Savings Performance Contract (ESPC) in partnership with a private sector energy service company (ESCO), Trane. Since ESPCs allow installations to pay for infrastructure improvements and energy projects with the savings generated by the projects over 10 to 25 years, initial funding did not come out of Dam Neck's budget.

In addition to installing GSHP for 10 buildings, the ESPC project includes an effluent-cooled condenser cooling water loop to 15 buildings, direct digital controls for 12 buildings, additional HVAC improvements in 14 buildings, lighting upgrades in 27 buildings and bathroom plumbing fixture upgrades in 36 buildings.

The Bottom Line

Energy Reduction

- Energy reduction of approximately 243,793 MBtu per year.
- Significant reduction in fuel oil and natural gas consumption.

Cost Avoidance

- Reduces energy costs by \$2.3 million annually, with an additional savings of \$500,000 in operations and maintenance costs. The cost avoidance will be used to pay the contractor over the contract term of 17 years.
- No initial financial outlay by the command due to the ESPC financing.

Collateral Benefits

- Improved thermal comfort.
- Eliminated above ground steam lines, improving the aesthetics of the base.

- Significantly lower ongoing maintenance requirement compared to traditional HVAC systems.
- Service contract included for the 17-year contract term.
- Prolonged life of cooling system since there are no outdoor condensing units exposed to the corrosive effects of the ocean.
- No noise outside buildings from condensing unit fans.
- Entirely computer-controlled and adjustable through the Internet.
- GSHP are classified as a renewable thermal technology and can help meet some renewable energy goals.
- Reduced water consumption compared to systems with boilers or cooling towers.
- Received the 2008 Engineering Excellence Award from the Engineers Club of Hampton Roads.

Feedback

"Summer is tough on the sailors because the age of the buildings is significant. Sailors bear a lot of the burden when they spend the nights with no AC and have to go back to work the next day. We're exceptionally happy to have this, and we're looking forward to enjoying the benefits of it."

NAS Oceana Executive Officer Capt. Mark Rich.

